Citation:

Barton BA, Eldridge AL, Thompson D, Affenito SG, Striegel-Moore RH, Franko DL, Albertson AM, Crockett SJ. The relationship of breakfast and cereal consumption to nutrient intake and body mass index: the National Heart, Lung, and Blood Institute Growth and Health Study. *J Am Diet Assoc.* 2005 Sep;105(9):1383-9.

PubMed ID: 16129079

Study Design:

Longitudinal Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To describe changes in breakfast and cereal consumption of girls between ages 9 and 19 years, and to examine the association of breakfast and cereal intake with BMI and consumption of nutrients.

Inclusion Criteria:

Participants from the National Heart, Lung and Blood Institute Growth and Health Study.

Exclusion Criteria:

None specifically mentioned.

Description of Study Protocol:

Recruitment

The National Heart, Lung and Blood Institute Growth and Health Study recruited girls aged 9 - 10 years at baseline, from locations in the Berkeley, CA; Cincinnati, OH and Washington, DC areas. Recruitment methods not described.

Design: Longitudinal cohort study

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- Generalized estimating equations methodology was used to examine differences in the

frequency of breakfast and cereal eating by age
- Generalized estimating equations and mixed models were used to examine whether breakfast and cereal consumption were predictive of BMI and nutrient intakes, adjusting for potentially confounding variables
- Days eating breakfast, days eating cereal and age were represented as ordinal variables
- Type III Wald chi-square tests were used to test the significance of predictors in the generalized estimating equations models

Data Collection Summary:

Timing of Measurements

- 3-day food records that had been previously validated were collected at annual visits 1 through 5 and then again at visits 7, 8 and 10

Dependent Variables

- Nutrient intake: dietary fat, fiber, calcium, cholesterol, iron, folic acid, vitamin C and zinc
- BMI calculated based on measurements of height and weight by trained research staff

Independent Variables

- Breakfast and cereal consumption estimated with annual 3-day food records
- Breakfast was defined as eating between 5 am and 10 am on weekdays or 5 am and 11 am on weekends
- Dietitians instructed girls to record all food and drink and time of intake for 3 consecutive days (2 weekdays and 1 weekend day).

Control Variables

- Age
- Site
- Mean daily energy intake

Description of Actual Data Sample:

Initial N: 2,379 girls at baseline

Attrition (final N):

- 1,015 at age 9
- 2,034 at age 10
- 1,879 at age 11
- 1,815 at age 12
- 1,731 at age 13
- 877 at age 14
- 829 at age 15
- 1,456 at age 16
- 772 at age 17
- 876 at age 18
- 963 at age 19

Age: aged 9 - 10 years at baseline

Ethnicity: 1,166 white and 1,213 black at baseline

Other relevant demographics:

Anthropometrics

Location: Berkeley, CA; Cincinnati, OH and Washington, DC

Summary of Results:

Key Findings

- Days of breakfast consumption and cereal consumption decreased significantly as girls grew older (both $P < 0.0001$).
- The patterns for both breakfast skipping and cereal breakfast showed more dramatic shifts, with younger girls much more often eating cereal breakfasts ($P < 0.0001$) and older girls skipping a significantly greater percentage of breakfasts entirely ($P < 0.0001$).
- Days eating breakfast were associated with higher calcium and fiber intake in all models, regardless of adjustment variables
- After adjusting for energy intake, compared with eating that did not involve cereal, cereal consumption was related to increased intake of fiber, calcium, iron, folic acid, vitamin C and zinc, and decreased intake of fat and cholesterol (all $P < 0.0001$).
- Days eating cereal was predictive of lower BMI ($P < 0.01$) but days eating breakfast was not predictive of either BMI indicator.
- Girls who ate cereal on 3 days out of 3 possible days had lower BMI than girls who did not eat cereal
- A similar trend was seen for breakfast consumption, with those consuming breakfast on 3 days having lower BMIs than girls who skipped breakfast on all or most days

Author Conclusion:

Cereal consumption may be one component of a healthful lifestyle that helps adolescent girls to maintain adequate nutrient intake and a healthful BMI. Cereal consumption may form part of an overall eating pattern that promotes maintenance of healthful body weights.

Reviewer Comments:

Inclusion/exclusion criteria and recruitment methods not described. Different number of subjects participating each year. 10-year follow-up.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	No
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	No
4.1.	Were follow-up methods described and the same for all groups?	???
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A

6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes

	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes